TRITIUM STACK EMISSION CALCULATION AND REPORTING

Purpose

This Meteorology and Air Quality Group (MAQ) procedure describes the process used to calculate and report tritium stack emissions monitored by an EG&G Labserco EL-700 bubbler. The method described in this procedure meets the requirements of 40 CFR 61, Subpart H (Rad-NESHAP).

Scope

This procedure applies to individuals in MAQ assigned to check, evaluate, report, and upload tritium emissions data from stacks monitored by an EG&G Labserco EL-700 bubbler.

In this procedure

This procedure addresses the following major topics:

Topic	See Page
General Information About This Procedure	2
Who Requires Training to This Procedure?	2
Verifying Tritium Data Package	4
Calculating Tritium Emissions	5
Adding Additional Tritium From Bubbler Calibrations	7
Reporting Measured Emissions to Facilities	8
Records Resulting from This Procedure	9

Signatures

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05/12/05

General information about this procedure

Attachments

This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Calculations Used in Tritium Emissions	2
2	Calculation Sheet for Tritium Bubbler Calibrations	1

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description of Changes
0	4/10/95	New document.
1	10/11/96	Includes new group structure and process changes.
2	9/27/99	Revised to describe use of spreadsheet used for calculations, equations moved to attachment, and checklist and calculation sheets added.
3	11/4/99	Revised Attachment 1.
4	8/23/00	Revised to describe use of database system to replace spreadsheet for data entry and checking.
5	10/15/01	Add lines to Attachment "Calculation Sheet" to clarify which value to enter into database, remove Attachment "Checklist For Tritium Stack Data Evaluation."
6	05/06/05	Changed HTO calculation process to incorporate efficiency factor, as described in Attachment 1 and the note in the chapter *Calculating tritium emissions*.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- MAQ personnel performing all or part of this procedure

Training method

The training method for this procedure is **on the job** training and is documented in accordance with the procedure for training (MAQ-024).

Prerequisites

In addition to training to this procedure, the following training is also required before performing this procedure:

- MAQ-118, "Categorizing and Reporting Increased Airborne Radioactive Emissions from Sampled Stacks"

General information about this procedure, continued

References

The following documents are referenced in this procedure:

- MAQ-024, "Personnel Training"
- MAQ-026, "Deficiency Reporting and Correcting"
- MAQ-106, "Collecting Tritium Stack Bubbler Samples"
- MAQ-118, "Categorizing and Reporting Increased Airborne Radioactive Emissions from Sampled Stacks"
- MAQ-139, "Analytical Chemistry Data Management and Review for Rad-NESHAP Program"
- HSR-4-RIC-DP-42, "Calibration Procedure of Tritium Bubblers Monitoring Stack Emissions"
- HSR-4-HPAL-DP-15, "Procedure for Liquid Scintillation Analysis"
- 40 CFR Part 61, subpart H, NESHAP
- Memo RRES-MAQ:04-089, "Change In Tritium Emissions Calculation Process For 2003 And Beyond," March 12, 2004.

Note

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

Verifying tritium data package

Background

Tritium emission sampling is performed using an EL-700 bubbler. This instrument collects tritium in vials containing ethylene glycol. These ethylene glycol samples are collected according to MAQ-106 and sent to HSR-4 Health Physic Analytical Laboratory (HPAL) for liquid scintillation counting.

HPAL transmits a liquid scintillation counting results EDD file to MAQ via e-mail for each set of ethylene glycol stack samples.

Check the analytical data

Follow MAQ-139 to verify and validate the analytical data and the data package.

Document and resolve any problems

If any of the criteria are not met, take appropriate action to resolve the discrepancies. Request re-aliquot and re-count if discrepancies cannot be resolved by checking analysis results.

If the verification identifies a problem requiring corrective action, initiate a deficiency report in accordance with procedure MAQ-026.

Calculating tritium emissions

Calculation of tritium emissions

The calculation of the emissions is performed by electronically uploading the HPAL data into an Access database.

In the event the tritium activities need to be calculated manually, or if the operation of the upload needs to be verified, perform the manual calculations given in Attachment 1.

Note on emissions calculations

The calculation process described in Attachment 1 was modified for emissions calculations in 2003 & beyond. The use of the bubbler response factor, $R_{bubbler}$, is now used for both tritium vapor (HTO) and gaseous tritium (HT) emissions. Prior to 2003, this response factor was only used for HT emissions, since the catalyst which converts HT gas to water vapor is the most likely point of reduced collection efficiency. However, with the start of EPA-required stack inspections in 2003, we now use the response factor for all emissions. This is so that the periodic bubbler performance test can be used in lieu of a visual stack inspection, per EPA approval in December 2003. More information is provided in memo RRES-MAQ:04-089.

Upload tritium data

Upload the data and calculate tritium stack emissions electronically by performing the following steps.

Step	Action
1	Open the Access database RADAIR. Click on “Forms” then click on “Main Switchboard.” Under the column “Chem Data,” click “Tritium Bubbler.”
2	Transfer of EDD file (Analytical data from HPAL) from e-mail to “Access table”. In Access open file "Get external data" → Import →Click Eudora→Click Attachments→Click file name (h3xx-xxmonth) by sample run date→EDD file now loaded into access.
3	On the screen “RADAIR Tritium Chemistry Data Mgt”: • Click Select R# (*RYYMMDD)* and select the file name for this period. • Under the column “EDD Upload & Archive”, click on button “Inspect DE table” and then, in sequence, each button in the column. • Under the column “Reports,” click each button in sequence.
4	From the query results “Inspect MS in Archive”, visually inspect the % recovery is 100 ±10%. If not within this range, check the raw data for proper upload, hand calculate the value to check the program, or notify HPAL to reanalyze the samples.

Steps continued next page

Calculating tritium emissions, continued

Step	Action
5	From the report "Tritium Expected Emissions Evaluation", if all is OK, sign and date the report. If any sources "Exceed" their expected levels, follow procedure MAQ-118 before proceeding with the next steps.
6	Add any new comments about a specific sample, if any data corrections or changes were made.
7	If there was a calibration of a bubbler during the sample period, perform the steps in the next chapter *Adding additional tritium from bubbler calibrations*.
8	Continue with the steps in the chapter *Reporting measured emissions to facilities*.

Adding additional tritium from bubbler calibrations

Background

HSR-4 performs calibrations of the stack bubblers every six months. To do the calibrations, they remove the bubbler vials, install their own, and release a known amount of tritium up the stacks. This released amount must be added to the amount measured by the bubbler samples during the sample period.

Calculation of tritium released

HSR-4 HPAL provides a memo to MAQ that documents the amount of tritium released during the calibrations. Using these data, hand-calculate the amount of tritium released (use Attachment 2, "Calculation Sheet for Tritium Bubbler Calibration"). Obtain an independent review of the calculations and sign the bottom of the form.

In the same database described in the previous chapter, go to the screen "Tritium Field Data Operations." Click on "Cal Gas Stacked Entry." Enter the amount of tritium 'stacked' for the calibration and, in the comments, enter the Curies of HT stacked during calibration.

Reporting measured emissions to facilities

Reporting emissions

Upload the tritium data to the web page *http://hotair.lanl.gov/AirQuality/* for reference by facility personnel. Send e-mail to the receiving groups with "Return receipt" requested.

Facility response to the tritium emission report

Facility personnel generally have five (5) business days after the return receipt is received by MAQ to challenge the reported tritium emission data or to report discrepancies to MAQ.

Investigation of emission report challenges

If the facility challenges the reported emission data or reports discrepancies, perform the following steps to investigate, resolve, and document the issues.

Step	Action
1	Verify the validity of calculation input data received from MAQ, and HSR-4. Verify bubbler calibration information, response factor, and stack flow information. Recheck emission calculations. If the discrepancy is valid and was due to MAQ data errors, initiate a DR according to MAQ-026.
2	Report the investigation results to the appropriate building manager or facility contact.
3	On the screen "RADAIR Tritium Chemistry Data Mgt": Under the column "Reports": • Click on the button "New Comments?" and document the investigation and results.

Filing and uploading measured tritium emission data

After five (5) business days and/or the resolution of reported discrepancies, place revised data on the LANL Air Quality Group (MAQ) web page (*http://hotair.lanl.gov/AirQuality/*).

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted as records **within one week of completion** to the records coordinator:

- Calculation Sheet for Tritium Bubbler Calibration (Attachment 2), when stack calibrations performed

CALCULATIONS USED IN TRITIUM EMISSIONS

Calculation of tritium emissions

These calculations are normally performed by an Access Database that is protected and revised, as necessary, in compliance with MAQ software QA requirements for verification and validation.

In the event the tritium activities need to be calculated manually, perform the following steps:

Step	Action
1	Verify you have the following activity data. A_1, A_2, A_3 = the activities measured in each sample vial of the first set of three bubbler vials (reported in μCi/l by HSR-4) A_4, A_5, A_6 = the activities measured in each sample vial of the second set of three bubbler vials (reported in μCi/L by HSR-4) A_{blank} = the activity measured in the blank vial (reported in μCi/L by HSR-4)
2	Verify you have the following weights. W_1, W_2, W_3 = the weight of ethylene glycol in each vial of the first set of three bubbler vials (reported in grams by HSR-1 or MAQ) W_4, W_5, W_6 = The weight of ethylene glycol in each vial of the second set of three bubbler vials (reported in grams by HSR-1 or MAQ)
3	Obtain the bubbler response factor ($R_{bubbler}$) reported by HSR-4. Note: If $R_{bubbler} > 1$, use $R_{bubbler} = 1$
4	Calculate the ratio of stack flow to bubbler flow. $$F_{ratio} = \frac{F_{stack}}{F_{bubbler} * CF}$$ Where:

Steps continued on next page.

CALCULATIONS USED IN TRITIUM EMISSIONS, CONTINUED

Step	Action
	F_{ratio} = the ratio of the flows F_{stack} = the current reportable stack volumetric flow rate (reported in actual cfm by MAQ) $F_{bubbler}$ = 150 actual cc/min, the volumetric flow rate of the bubbler CF = 3.53E-05 ft^3/cc Conversion factor to convert actual cc/min to actual cfm
5	Calculate the volume of ethylene glycol in each bubbler vial : (V_1, V_2, V_3, V_4, V_5, V_6) $$V_i = \frac{W_i}{\rho}$$ Where: V_i = Volume of the ith vial in mL (i = 1 to 6) W_i = Weight of the ith vial in grams ρ = Density of ethylene glycol = 1.113 g/mL
6	Calculate the HTO activity (Ci) collected: $$A_{HTO} = \frac{(A_1 - A_{blank})*V_1 + (A_2 - A_{blank})*V_2 + (A_3 - A_{blank})*V_3}{\left(1000\frac{mL}{L}\right)*\left(1{,}000{,}000\frac{\mu Ci}{Ci}\right)}$$
7	Calculate the HT activity (Ci) collected: $$A_{HT} = \frac{(A_4 - A_{blank})*V_4 + (A_5 - A_{blank})*V_5 + (A_6 - A_{blank})*V_6}{\left(1000\frac{mL}{L}\right)*\left(1{,}000{,}000\frac{\mu Ci}{Ci}\right)}$$
8	Calculate the HTO activity (Ci) emitted: $$HTO_{Emitted} = E_{HTO} = \frac{F_{ratio} * A_{HTO}}{R_{bubbler}}$$
9	Calculate the HT activity (Ci) emitted: $$HT_{Emitted} = E_{HT} = \frac{F_{ratio} * A_{HT}}{R_{bubbler}}$$

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CALCULATION SHEET FOR TRITIUM BUBBLER CALIBRATIONS

This form is from MAQ-112

Stack ID: _____ Bubbler Calibration by HSR-4 on date: _____

Bubbler Response: _____

HTO

Total dpm/ml collected = = dpm/ml (dpm/ml) (30ml) =

$\mu Ci\ collected = \frac{Total\ activity\ [dpm]}{2.22E6\ [dpm/\mu Ci]} =$

$\mu Ci\ emitted = \mu Ci\ collected \times F_{stack} / F_{sample} =$

$Correct\ for\ downtime = \mu Ci\ emitted \times \frac{Total\ cal\ time}{Total\ release\ time} =$

HTO entry to database = µCi

HT

Total dpm/ml collected = Total activity collected = (_____ dpm/ml) (30ml) =

$\mu Ci\ collected = \frac{total\ activity\ [dpm]}{2.22E6\ [dpm/\mu Ci]} =$

$\mu Ci\ emitted = \mu Ci\ collected \times F_{stack} / F_{sample} =$

$Correct\ for\ downtime = \mu Ci\ emitted \times \frac{Total\ cal\ time}{total\ release\ time} =$

HT stacked = mCi/ 1000 = Ci*

HT stacked + collected = Ci

HT entry to database (stacked + collected) = µCi

*NOTE: Add comment to database for stack field data: "_____Ci HT stacked during calibration"

Calculated by:

_____	_____	_____
Signature	Name (print)	Date

Verified by:

_____	_____	_____
Signature	Name (print)	Date

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CALCULATION SHEET FOR TRITIUM BUBBLER CALIBRATIONS

This form is from MAQ-112

Stack ID: _____ Bubbler Calibration by HSR-4 on date: _____

Bubbler Response: _____

HTO

Total dpm/ml collected = = dpm/ml (dpm/ml) (30ml) =

μCi collected = $\frac{\text{Total activity [dpm]}}{\text{2.22E6 [dpm/}\mu\text{Ci]}}$ =

μCi emitted = μCi collected x F_{stack} / F_{sample} =

Correct for downtime = μCi emitted x $\frac{\text{Total cal time}}{\text{Total release time}}$ =

HTO entry to database = μCi

HT

Total dpm/ml collected = Total activity collected = (_____ dpm/ml) (30ml) =

μCi collected = $\frac{\text{total activity [dpm]}}{\text{2.22E6 [dpm/}\mu\text{Ci]}}$ =

μCi emitted = μCi collected x F_{stack} / F_{sample} =

Correct for downtime = μCi emitted x $\frac{\text{Total cal time}}{\text{total release time}}$ =

HT stacked = mCi/ 1000 = Ci*

HT stacked + collected = Ci

HT entry to database (stacked + collected) = μCi

*NOTE: Add comment to database for stack field data: "_____Ci HT stacked during calibration"

Calculated by:

_____ _____ _____

Signature Name (print) Date

Verified by:

_____ _____ _____

Signature Name (print) Date